A version marked up to show changes made to the specification relative to the previous version of the specification is attached.

Remarks

The rejections stated in the Official Action have been carefully considered and reconsideration is requested for the following reasons.

1. The rejection of claims 1 and 4-6 as anticipated by Asakura et al. (U.S. Pat. No. 4,645,702) is traversed because Asakura et al. does not teach a flame treatment "where the flame is supported by an oxidizer and fuel mixture that includes at least one sulfur-containing compound that functions as a fuel substitute," as recited in applicants' claim 1.

Asakura et al. is directed to a magnetic recording medium comprising an aromatic polyamide film and a magnetic layer vapor-deposited on the film. To improve adhesion of the magnetic layer to the film, Asakura et al. teaches a surface treatment of the film, including "a corona discharge treatment, a low temperature plasma treatment and a flame treatment, which are conducted in various atmospheres" (col. 9, lines 48-54; emphasis added). Among the gases used in the atmosphere is hydrogen sulfide (col. 9, line 58).

A treatment as described in Asakura et al using a gaseous atmosphere would not be the same as a process of applicants' invention. "Atmosphere" means the space surrounding the film being treated, and that is clearly what Asakura means by using the term "atmosphere." A corona discharge treatment and a plasma treatment, which are the first treatments referred to by Asakura, act in a known manner on the gas molecules of an atmosphere to effectuate a treatment of the film. It is essential in such a treatment that the gas molecules be part of an atmosphere for the treatment to be operative.

But such a use of gas molecules in an atmosphere is not at all the same as supplying a flammable gas to a flame as part of an oxidizer-fuel mixture that supports the flame. A fuel mixture is supplied to a flame in a controlled and precise manner such that there is a needed balance for combustion, and so the flame is controlled for safety and is located appropriately with respect to the film surface; see, among other places in applicants' specification, page 5, line 25, through page 6, line 6, and the examples.

There is no suggestion in Asakura et al that it is intended that a flammable atmosphere surround the flame treatment mentioned at column 9, lines 52 and 53. There are many nonflammable gases listed in lines 55-58, and it must be presumed that it was intended that one of

these nonflammable gases be used with a flame treatment. Otherwise, surrounding a flame with a flammable gaseous atmosphere would be uncontrolled and possibly dangerous.

Actually, it seems that flame treatment was a kind of throw-in in the list of treatments. There are no details about how to use the flame treatment, and none of the examples uses a flame treatment.

Most importantly, there are none of the teachings that would be needed to explain how the gases would be used to support a flame. Simply having a gas present in an atmosphere around a flame is not "supporting" a flame; instead it would be an explosive situation that is contrary to the whole idea of supporting a flame.

Applicants carefully teach, and the art well understands, what is meant by supporting a flame with a fuel-oxidizer mixture. Fuel and oxidizer are brought to the flame and fed to the flame in a controlled and measured manner. There is not a word in Asakura to suggest that Asakura has such a process in mind. To the contrary, Asakura's reference to an atmosphere and to treatments that depend on an atmosphere makes clear that Asakura has no intention that the listed gases support a flame. This conclusion is also reinforced by Asakura's inclusion of gases that are not flammable (for example, as discussed in Section 2 below, sulfur dioxide included in Asakura's list is not a fuel); Asakura does not distinguish flammable and nonflammable gases, indicating that flammability is irrelevant to the processes Asakura has in mind.

In summary, there is no teaching in Asakura that a gas, e.g., hydrogen sulfide, be fed to a flame as part of a fuel-oxidizer mixture to support the flame, as called for in applicants' claims.

2. The rejection of claims 1, 5 and 7-8 as anticipated by JP 10-130947 is traversed because, among other reasons, there is no teaching in JP '947 of supporting a flame with an oxidizer-fuel mixture that includes at least one "sulfur-containing compound that functions as a fuel substitute," as called for in applicants' claims.

JP '947 is directed to polyolefin fibers, which are treated with an oxidation treatment to make the fibers hydrophilic (page 4 of the translation, paragraph [0005]). The oxidation treatment is performed by a variety of techniques, one of which is called the "flame method" (translation, page 7, line 4). The treatment is conducted in an environment where there is an inert gas and a reactive gas. One category of reactive gas is "sulfur dioxides (for example, SO_2, SO_3, etc.)" (page 7, line 10).

Sulfur oxides are not flammable and not useful as a "fuel substitute" as called for in applicants' claims. No sulfur-containing materials other than sulfur oxide are recited by JP'947 for

use in the described flame method, so there can be no teaching of a "sulfur-containing compound that functions as a fuel substitute." Setting aside the issue of what JP'947 means by a "flame method," this reference fails as an anticipation of applicants' claimed invention simply from the fact that there is no teaching in the reference of a sulfur-containing fuel substitute as called for in applicants' claims.

With respect to paragraph [0014] of JP '947, this paragraph teaches a two-step sequence in which "a monomer that demonstrates hydrophilic properties" is coated in advance on a fiber material, and then an oxidation treatment is applied. The material to be coated includes various sulfonic acids. The latter are not fuel substitutes, which is a first fatal deficiency of this teaching as art against applicants' claims. Furthermore, there is no indication that a flame is applied to the coated liquid or that the coated liquid could function as a fuel substitute in the fuel-oxidizer mixture of applicants' claims.

Paragraph [0015] of JP'947 is deficient in the same way – i.e., there is no mention of a sulfur-containing compound that functions as a fuel substitute. Further, there is no mention of any use of a flame in the technique of this paragraph; the treatment is completed by immersion in a liquid; see Practical Example 7 in paragraph [0029].

3. Paragraph 6 of the Office Action rejects claims 2-3 and 7-12 under 35 U.S.C. 103 (a) as unpatentable over Asakura in view of admitted prior art, based on a consideration of the fuel-rich or fuel-lean nature of the mixture used by Asakura to support a flame. However, as discussed above, Asakura has a more basic deficiency than whether the fuel mixture is fuel-rich or fuel-lean. Asakura has no teaching of supporting a flame "by an oxidizer and fuel mixture that includes at least one sulfur-containing compound that functions as a fuel substitute." Thus, one need not even reach the issue whether the fuel mixture is fuel-rich or fuel-lean. Asakura fails as a reference because there is no teaching of the recitations of the independent claim from which claims 2-3 and 7-12 depend.

(With respect to the merits of the rejections of paragraph 6, it is noted that the benefits and results recited in claims 7-12 are new and unexpected, and not simply the result of routine experimentation. Similarly the prior art does not teach that there are unique benefits to making the fuel-oxidizer mixture in a method as recited in independent claim 1 fuel-lean or fuel-rich, as recited in claims 2 and 3.)

4. Paragraph 7 rejects claims 1-12 as unpatentable under 35 U.S.C 103 (a) over the admitted prior art in view of Asakura. A key premise of the rejection is the statement in the

middle of the paragraph that Asakura teaches that "sulfur dioxide and hydrogen sulfide are effective equivalent gases to carbon dioxide, carbon monoxide, hydrogen, and nitrogen ... in improving the adhesion and bondability of polymer films." As discussed above, the quoted statement is not correct, because the cited "admitted" prior art and Asakura are directed to different processes. Specifically, the cited prior art teaches use of the named ingredients carbon dioxide, carbon monoxide, hydrogen, and nitrogen as fuel substitutes for supporting a flame. On the other hand, Asakura teaches the use of sulfur dioxide and hydrogen sulfide as gaseous atmospheres for treatments in which the gaseous molecules of the atmosphere are acted upon, e.g. by a plasma field, etc., including apparently a flame. The differences between the two processes mean that they do not establish an equivalence between hydrogen sulfide, on the one hand, and carbon dioxide et al, on the other hand. The gaseous materials of these two different processes are acted upon and function in different ways.

Incidentally, the inclusion of sulfur dioxide with hydrogen sulfide in Asakura's list of gaseous materials reinforces the lack of equivalence, because sulfur dioxide could never be a fuel; the inclusion of the non-fuel sulfur dioxide in Asakura's list confirms that Asakura does not intend that the listed gaseous materials function as a fuel.

5. Paragraph 8 rejects claims 2-3 as unpatentable over JP '947. But as discussed above, because the sulfur-containing compounds taught in JP '947, such as sulfur dioxide and sulfonic acids, are not fuel substitutes, and for the other reasons noted, JP '947 can not be a basis for rejection irrespective of considerations of fuel-rich and fuel-lean atmospheres.

6. An International Search Report has been received for the PCT counterpart to the present application. Four patents are cited in the search, as listed on the attached Information Disclosure Statement and completed form PTO 1449 (*Modified*). (U.S. Patent No. 5,900,317 was included on form PTO 1449 submitted to the US PTO on February 6, 2001 and therefore is not listed again.) None of the listed references teaches applicants' invention or renders the invention obvious. Seibel, U.S Patent No. 3,364,056, teaches a process for improving adhesivity of a polyolefin surface by a flame treatment in which the flame is supported by a combustible gas to which is added a noncombustible halogen and/or halogen-containing compound. Other noncombustible gases can be included such as sulfur dioxide (col. 2, l. 14). Among the halogen-containing compounds are sulfuryl chloride, thionyl chloride, and chlorosulfonic acid (col. 2, ll. 23-24). This reference does not teach use of a sulfur-containing compound as a fuel substitute;

in fact, Seibel states that the composition of the combustible gas has no effect on the intended results (col. 1, l. 69 et seq.).

Strobel et al, U.S. Patent No. 5,900,317, is directed to processes for modifying the surface of a polymeric substrate by exposing the substrate to a flame that is supported by a fuel and oxidizer mixture that includes at least one silicon-containing compound that functions as a fuel. No teaching is made about use of a sulfur-containing compound as a fuel substitute in the flame treatment.

Doss, U.S. Patent No. 4,011,121, is directed to an adhesion-improving pretreatment of poly(arylene sulfide) surfaces by, among others treatments, exposing the surface to a flame. The flame is supported by standard gaseous fuels such as propane, butane or natural gas (col. 4, ll. 9-29). No mention is found of supporting a flame with a mixture that includes a flammable sulfur-containing compound. Although the surface to be treated comprises a sulfur-containing polymer, there is no suggestion that the sulfur-containing polymer supports the flame applied to it.

Keane et al, U.S. Patent No. 3,431,135, teaches flame-treating polyethylene terephthalate film to improve adhesion to a coating of aluminum vapor-deposited on the film. No mention is found of use of a sulfur-containing compound in the flame.

It is accordingly believed that this application is in condition for allowance, and a notice to that effect is respectfully solicited.

Respectfully submitted,

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Version With Markings to Show Changes Made

Please replace the paragraph on page 19, beginning on line 4 and ending on line 10 with the following amended paragraph:

The present invention provides a method of modifying the surface of a polymeric substrate, e.g., to improve the wettability of the polymer film surface and/or alter the metal adhesion properties of the surface of the substrate by exposing the substrate to a flame. The flame is supported by an oxidizer and fuel mixture that includes an effective amount, for modifying the polymeric substrate, of at least one sulfur-containing compound that functions as a fuel substitute. In addition, substrates are provided that have increased wettability or increased metal adhesion performance.

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